WHAT IS CLAIMED IS:

1. A microfluidic reactor comprising:

a plurality of flow-through reaction cells for parallel chemical reactions, each reaction cell comprising:

i. at least one illumination chamber, and

ii. at least one reaction chamber,

wherein the illumination chamber and the reaction chamber are in flow communication and are spatially separated in the reaction cell.

2. A microfluidic reactor according to claim 1, wherein the reactor comprises at least 10 reaction cells.

3. A microfluidic reactor according to claim 1, wherein the reactor comprises at least 100 reaction cells.

4. A microfluidic reactor according to claim 1, wherein the reactor comprises at least 1,000 reaction cells.

5. A microfluidic reactor according to claim 1, wherein the reactor comprises at least 10,000 reaction cells.

6. A microfluidic reactor according to claim 1, wherein the reactor comprises 900 to 10,000 reaction cells.

7. A microfluidic reactor according to claim 1, wherein the reaction cells are adapted for use of in situ generated chemical reagents which are generated in the illumination chamber.

8. A microfluidic reactor according to claim 1, wherein the reactor comprises a silicon microfluidic template.

9. A microfluidic reactor according to claim 1, wherein the reactor comprises a plastic microfluidic template.

10. A microfluidic reactor according to claim 1, wherein a distance between reaction cells which are adjacent to each other is 10 to 5,000 microns.

11. A microfluidic reactor according to claim 1, wherein a distance between reaction cells which are adjacent to each other is 10 to 2,000 microns.

12. A microfluidic reactor according to claim 1, wherein a distance between reaction cells which are adjacent to each other is 10 to 500 microns.

13. A microfluidic reactor according to claim 1, wherein a distance between reaction cells which are adjacent to each other is 10 to 200 microns.

14. A microfluidic reactor according to claim 1, wherein a distance between reaction cells which are adjacent to each other is larger than 5,000 microns.

15. A microfluidic reactor according to claim 1, wherein the reactor comprises a microfluidic template and at least one window plate.

16. A microfluidic reactor according to claim 1, wherein the reactor further comprises at least one shadow mask.

17. A microfluidic reactor according to claim 1, wherein the reactor is adapted to avoid chemical intermixing between the reaction cells.

18. A microfluidic reactor according to claim 1, wherein the reactor further comprises an inlet channel and an inlet restriction gap connected to the illumination chamber, and an outlet channel and an outlet restriction gap connected to the illumination chamber.

19. A microfluidic reactor according to claim 1, wherein the reactor further comprises inlet channels and inlet restriction gaps in fluid communication with the illumination chambers of the reaction cells, and wherein the reactor further comprises outlet channels and outlet restriction gaps in fluid communication with the reaction chambers of the reaction cells, and wherein illumination chambers and reaction chambers of the reaction cells are connected by connection channels.

20. A microfluidic reactor according to claim 1, wherein the reactor further comprises one common inlet channel, branch inlet channels, branch outlet channels, and one common outlet channel.

21. A microfluidic reactor according to claim 1, wherein the reactor further comprises immobilized molecules in the reaction chamber.

22. A microfluidic reactor according to claim 21, wherein the immobilized molecules are biopolymers.

23. A microfluidic reactor according to claim 21, wherein the immobilized molecules are immobilized with use of linker molecules.

24. A microfluidic reactor according to claim 21, wherein the immobilized molecules are selected from the group consisting of DNA, RNA, DNA oligonucleotides, RNA oligonucleotides, peptides, oligosaccharides, and phospholipids.

25. A microfluidic reactor according to claim 21, wherein the immobilized molecules are oligonucleotides.

26. A microfluidic reactor according to claim 1, wherein the reactor further comprises DNA, RNA, DNA oligonucleotides, RNA oligonucleotides, peptides, oligosaccharides, phospholipids, or combinations thereof adsorbed to the reaction chamber.

27. A microfluidic reactor according to claim 1, wherein the reactor further comprises immobilized molecules in a double-layer configuration in the reaction chamber.

28. A microfluidic reactor according to claim 1, wherein the reactor further comprises a three-dimensional attachment of immobilized molecules in the reaction chamber.

29. A microfluidic reactor according to claim 1, further comprising porous films in the reaction chamber.

30. A microfluidic reactor according to claim 29, wherein the porous films are porous glass films or porous polymer films.

31. A microfluidic reactor according to claim 1, wherein the reaction chambers are in capillary form.

32. A microfluidic reactor according to claim 31, wherein the reaction chambers in capillary form have diameters of 0.05 micrometers to 500 micrometers.

33. A microfluidic reactor according to claim 31, wherein the reaction chambers in capillary form have diameters of 0.1 micrometers to 100 micrometers.

34. A microfluidic reactor according to claim 1, wherein the reactor is in the form of an array device chip comprising fluid channels to distribute fluid to the plurality of reaction cells for parallel chemical reaction.

35. A microfluidic reactor according to claim 34, wherein the fluid channels have a first cross sectional area, the reaction cells have a second cross sectional area which is smaller than the first cross sectional area, and the ratio between the first and second cross sectional areas is 10 to 10,000.

36. A microfluidic reactor according to claim 34, wherein the fluid channels have a first cross sectional area, the reaction cells have a second cross sectional area which is smaller than the first cross sectional area, and the ratio between the first and second cross sectional areas is 100 to 10,000.

37. A microfluidic reactor according to claim 34, wherein the fluid channels have a first cross sectional area, the reaction cells have a second cross sectional area which is smaller than the first cross sectional area, and the ratio between the first and second cross sectional areas is 1,000 to 10,000.

38. A microfluidic reactor according to claim 34, wherein the fluid channels are tapered.

39. A microfluidic reactor according to claim 38, wherein the tapered fluid channels provide uniform flow rates across reaction cells along the fluid channels.

40. A microfluidic reactor according to claim 1, wherein the reaction chambers contain beads.

41. A microfluidic reactor according to claim 1, wherein the reaction chambers contain resin pads.

42. A microfluidic reactor according to claim 1, wherein the reactor comprises an array of oligonucleotides in the reaction chamber, a microfluidic template made of silicon, and first and second window plates made of glass and attached to the template.

43. A microfluidic reactor according to claim 1, wherein the device comprises an array of oligonucleotides in the reaction chambers, a microfluidic template made of silicon, window plates, a shadow mask, inlet channels and inlet restriction gaps connected to the illumination chambers, outlet channels and outlet restriction gaps connected to the reaction chambers, distribution channels for parallel reactions in the reaction cells, and connection channels to connect illumination and reaction chambers.

44. A microfluidic reactor according to claim 43, wherein the reactor is in the form of an array device chip comprising fluid channels to distribute fluid to the plurality of reaction cells for parallel chemical reactions.

45. A microfluidic reactor according to claim 44, wherein the reactor comprises at least 10 reaction cells.

46. A microfluidic reactor according to claim 45, wherein the oligonucleotides are immobilized with use of linker molecules.

47. A microfluidic reactor according to claim 46, wherein the reaction cells, illumination chambers, and reaction chambers are adapted for use of in situ generated chemical reagents.

48. A chip comprising a plurality of microfluidic reactors according to claim 1.

49. A chip comprising a plurality of microfluidic reactors according to claim 43.

50. A microfluidic reactor comprising a plurality of flow-through photoillumination reaction cells for parallel chemical reactions in fluid communication with at least one inlet channel and at least one outlet channel.

51. A microfluidic reactor according to claim 50, wherein the reactor comprises at least 10 reaction cells.

52. A microfluidic reactor according to claim 50, wherein the reactor comprises at least 100 reaction cells.

53. A microfluidic reactor according to claim 50, wherein the reactor comprises at least 1,000 reaction cells.

54. A microfluidic reactor according to claim 50, wherein the reactor comprises at least 10,000 reaction cells.

55. A microfluidic reactor according to claim 50, wherein the reactor comprises 900 to 10,000 reaction cells.

56. A microfluidic reactor according to claim 50, wherein the reaction cells are adapted for use of in situ generated chemical reagents which are generated in the reaction cell.

57. A microfluidic reactor according to claim 50, wherein the reactor comprises a silicon microfluidic template.

58. A microfluidic reactor according to claim 50, wherein the reactor comprises a plastic microfluidic template.

59. A microfluidic reactor according to claim 50, wherein a distance between reaction cells which are adjacent to each other is 10 to 5,000 microns.

60. A microfluidic reactor according to claim 50, wherein a distance between reaction cells which are adjacent to each other is 10 to 2,000 microns.

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61. A microfluidic reactor according to claim 50, wherein a distance between reaction cells which are adjacent to each other is 10 to 500 microns.

62. A microfluidic reactor according to claim 50, wherein a distance between reaction cells which are adjacent to each other is 10 to 200 microns.

63. A microfluidic reactor according to claim 50, wherein a distance between reaction cells which are adjacent to each other is larger than 5,000 microns.

64. A microfluidic reactor according to claim 50, wherein the reactor comprises a microfluidic template and at least one window plate.

65. A microfluidic reactor according to claim 50, wherein the reactor further comprises at least one shadow mask.

66. A microfluidic reactor according to claim 50, wherein the reactor is adapted to avoid chemical intermixing between the reaction cells.

67. A microfluidic reactor according to claim 50, wherein the reactor further comprises inlet restriction gaps and outlet restriction gaps connected to the reaction cells.

68. A microfluidic reactor according to claim 50, wherein the reactor further comprises one common inlet channel, branch inlet channels, branch outlet channels, and one common outlet channel.

69. A microfluidic reactor according to claim 50, wherein the reactor further comprises immobilized molecules in the reaction cell.

70. A microfluidic reactor according to claim 69, wherein the immobilized molecules are biopolymers.

71. A microfluidic reactor according to claim 69, wherein the immobilized molecules are immobilized with use of linker molecules.

72. A microfluidic reactor according to claim 69, wherein the immobilized molecules are selected from the group consisting of DNA, RNA, DNA oligonucleotides, RNA oligonucleotides, peptides, oligosaccharides, and phospholipids.

73. A microfluidic reactor according to claim 69, wherein the immobilized molecules are oligonucleotides.

74. A microfluidic reactor according to claim 50, wherein the reactor further comprises DNA, RNA, DNA oligonucleotides, RNA oligonucleotides, peptides, oligosaccharides, phospholipids, or combinations thereof adsorbed to the reaction cell.

75. A microfluidic reactor according to claim 50, wherein the reactor further comprises immobilized molecules in a double-layer configuration in the reaction cell.

76. A microfluidic reactor according to claim 50, wherein the reactor further comprises a three-dimensional attachment of immobilized molecules in the reaction cell.

77. A microfluidic reactor according to claim 50, further comprising porous films in the reaction cell.

78. A microfluidic reactor according to claim 77, wherein the porous films are porous glass films or porous polymer films.

79. A microfluidic reactor according to claim 50, wherein the reaction cells are in capillary form.

80. A microfluidic reactor according to claim 79, wherein the reaction cells in capillary form have diameters of 0.05 micrometers to 500 micrometers.

81. A microfluidic reactor according to claim 79, wherein the reaction chambers in capillary form have diameters of 0.1 micrometers to 100 micrometers.

82. A microfluidic reactor according to claim 50, wherein the reactor is in the form of an array device chip comprising fluid channels to distribute fluid to the plurality of reaction cells for parallel chemical reactions.

83. A microfluidic reactor according to claim 82, wherein the fluid channels have a first cross sectional area, the reaction cells have a second cross sectional area which is smaller than the first cross sectional area, and the ratio between the first and second cross sectional areas is 10 to 10,000.

84. A microfluidic reactor according to claim 82, wherein the fluid channels have a first cross sectional area, the reaction cells have a second cross sectional area which is smaller than the first cross sectional area, and the ratio between the first and second cross sectional areas is 100 to 10,000.

85. A microfluidic reactor according to claim 82, wherein the fluid channels have a first cross sectional area, the reaction cells have a second cross sectional area which is smaller than the first cross sectional area, and the ratio between the first and second cross sectional areas is 1,000 to 10,000.

86. A microfluidic reactor according to claim 82, wherein the fluid channels are tapered.

87. A microfluidic reactor according to claim 86, wherein the tapered fluid channels provide uniform flow rates across reaction cells along the fluid channels.

88. A microfluidic reactor according to claim 50, wherein the reaction cells contain beads.

89. A microfluidic reactor according to claim 50, wherein the reaction cells contain resin pads.

90. A microfluidic reactor according to claim 50, wherein the reactor comprises an array of oligonucleotides in the reaction cells, a microfluidic template made of silicon, and first and second window plates made of glass bonded to the template.

91. A microfluidic reactor according to claim 50, wherein the device comprises an array of oligonucleotides in the reaction cells, a microfluidic template made of silicon, window plates, a shadow mask, inlet restriction gaps connected to the reaction cells, outlet restriction gaps connected to the reaction cells, and distribution channels to connect the reaction cells for parallel chemical reactions.

92. A microfluidic reactor according to claim 50, wherein the reactor is in the form of an array device chip comprising fluid channels to distribute fluid to the plurality of reaction cells for parallel chemical reactions.

93. A microfluidic reactor according to claim 92, wherein the reactor comprises at least 10 cells.

94. A microfluidic reactor according to claim 91, wherein the oligonucleotides are immobilized with use of linker molecules.

95. A microfluidic reactor according to claim 94, wherein the reaction cells are adapted for use of in situ generated chemical reagents.

96. A microfluidic reactor according to claim 50, wherein the inlet channel and the outlet channel are located on the same side of a microfluidic template.

97. A microfluidic reactor according to claim 50, wherein the reactor comprises one common inlet channel and one common outlet channel.

98. A microfluidic reactor according to claim 50, wherein the reaction cells each comprise an illumination chamber and a reaction chamber which partially overlap each other.

99. A chip comprising a plurality of microfluidic reactors according to claim 50.

100. A microfluidic reactor comprising at least one microfluidic template and window plates attached to the template, the microfluidic template and window plates defining a plurality of reaction cells which provide for flow of liquid solution through the cells for parallel chemical reactions, each reaction cell comprising a first chamber in fluid communication with but spatially separated from a second chamber, the first chamber being adapted to be an illumination chamber, and the second chamber being adapted to be a reaction chamber for reaction of photo-generated products in the first chamber.

101. A microfluidic reactor according to claim 100, wherein the plates are attached by covalent attachment.

102. A microfluidic reactor according to claim 100, wherein the plates are attached by non-covalent attachment.

103. A microfluidic reactor according to claim 100, wherein the first and second chambers are in fluid communication by a connection channel.

104. A microfluidic reactor according to claim 100, wherein the first chamber is connected to an inlet channel, the second chamber connected to an outlet channel, and the plurality of reaction cells are connected by distribution channels for parallel chemical reactions.

105. A microfluidic reactor according to claim 104, wherein the first and second chambers are in fluid communication by a connection channel.

106. A microfluidic reactor according to claim 100, wherein the second chambers comprise at least one surface having immobilized molecules thereon.

107. A microfluidic reactor according to claim 100, wherein the second chambers comprise at least two surfaces having immobilized molecules thereon.

108. A microfluidic reactor according to claim 100, wherein the second chambers comprise a three dimensional array of surfaces having immobilized molecules thereon.

109. A microfluidic reactor according to claim 100, wherein the second chambers comprise immobilized oligonucleotides.

110. A microfluidic reactor comprising at least one microfluidic template and window plates attached to the template, the reactor providing at least one inlet channel, at least one outlet channel, and distribution channels, and a plurality of liquid flow-through photoillumination reaction cells for parallel chemical reactions.

111. A microfluidic reactor according to claim 110, wherein the plates are attached by covalent attachment.

112. A microfluidic reactor according to claim 110, wherein the plates are attached by non-covalent attachment.

113. A microfluidic reactor according to claim 110, wherein the reaction cells comprise at least one surface having immobilized molecules thereon.

114. A microfluidic reactor according to claim 110, wherein the reaction cells comprise at least two surfaces having immobilized molecules thereon.

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115. A microfluidic reactor according to claim 110, wherein the reaction cells comprise a three dimensional array of surfaces having immobilized molecules thereon.

116. A microfluidic reactor according to claim 110, wherein the reaction cells comprise immobilized oligonucleotides.

117. A microfluidic reactor according to claim 110, wherein the reactor comprises a common inlet channel and a common outlet channel.

118. A microfluidic reactor according to claim 110, wherein the reactor comprises a common inlet channel.

119. A microfluidic reactor according to claim 110, wherein the reactor comprises a common outlet channel.

120. A microfluidic reactor comprising:

a plurality of flow-through reaction cells in fluid communication with each other via distribution channels for parallel chemical reactions, each reaction cell comprising:

i. at least one illumination chamber, and

ii. at least one reaction chamber,

wherein the illumination chamber and the reaction chamber are in flow communication and overlap with each other in the reaction cell.

121. A microfluidic reactor according to claim 120, wherein the overlap of chambers is a partial overlap.

122. A microfluidic reactor according to claim 120, wherein the overlap of chambers is a total overlap.

123. A microfluidic reactor according to claim 120, wherein the reaction cells are adapted for use of in situ generated chemical reagents.

124. A microfluidic reactor according to claim 120, wherein the reactor is adapted to avoid chemical intermixing between the reaction cells.

125. A microfluidic reactor according to claim 120, wherein the reactor comprises at least 10 reaction cells.

126. A microfluidic reactor according to claim 120, wherein the reactor comprises immobilized molecules.

127. A microfluidic reactor according to claim 126, wherein the immobilized molecules are selected from the group consisting of DNA, RNA, DNA oligonucleotides, RNA oligonucleotides, peptides, oligosaccharides, and phospholipids.

128. A microfluidic reactor according to claim 126, wherein the immobilized molecules are oligonucleotides.

129. A microfluidic reactor according to claim 120, wherein the reactor comprises a common inlet and a common outlet.

130. A high-density flowthrough multi-cell microfluidic reactor comprising a microfluidic template, at least one inlet channel, at least one outlet channel, and a plurality of flow through reaction cells for parallel chemical reactions, wherein the inlet channel and outlet channel are imbedded in the mid-section of the microfluidic template.

131. The reactor of claim 130, wherein each flow through reaction cell comprises a spatially separated illumination chamber and reaction chamber, which are in fluid communication with each other.

132. The reactor of claim 131, wherein the illumination chamber and reaction chamber are connected by a channel.

133. The reactor of claim 130, wherein the reaction chamber comprises immobilized molecules.

134. The reactor of claim 133, wherein the immobilized molecules are oligonucleotides.

135. A microfluidic reactor comprising a microfluidic template, a back plate attached to the template, and a window plate attached to the template, wherein the reactor comprises a plurality of flow-through reaction cells in fluid communication with an inlet channel and an outlet channel for parallel chemical reactions, wherein the inlet channel and the outlet channel are located between the back plate and the microfluidic template.

136. The reactor according to claim 135, wherein the reactor further comprises a shadow mask on the window plate.

137. The reactor according to claim 135, wherein the reaction cells comprise immobilized molecules.

138. The reactor according to claim 137, wherein the immobilized molecules are oligonucleotides.

139. The reactor according to claim 137, wherein the immobilized molecules are disposed on at least two surfaces of the reaction cell.

140. A microfluidic reactor comprising a plurality of flow-through photoillumination reaction cells for parallel chemical reactions in fluid communication with at least one inlet channel and at least one outlet channel, wherein the reaction cells are connected to fluid distribution channels in parallel which comprise a through-hole at their end so that fluid can flow through the channel without passing through the reaction cells.

141. A microfluidic reactor according to claim 140, wherein the through hole is in fluid communication with the outlet channel.

142. A microfluidic reactor according to claim 140, wherein the reaction cells comprise a photoillumination chamber and a reaction chamber which are in fluid communication and are spatially separated.

143. A microfluidic reactor according to claim 140, wherein the reaction cells comprise a photoillumination chamber and a reaction chamber which partially overlap with each other.

144. A microfluidic reactor according to claim 140, wherein the reaction cells comprise a photoillumination chamber and a reaction chamber which completely overlap with each other.

145. A microfluidic reactor comprising a plurality of flow-through photoillumination reaction cells for parallel chemical reactions in fluid communication with at least one inlet channel and at least one outlet channel, wherein the reaction cells are connected in parallel with fluid distribution channels, wherein each reaction cell has a separate outlet channel which allows for individual collection of effluent from each reaction cell.

146. A microfluidic reactor according to claim 145, wherein the reaction cells comprise a photoillumination chamber and a reaction chamber which are in fluid communication and are spatially separated.

147. A microfluidic reactor according to claim 146, wherein the photoillumination chamber and the reaction chamber are connected by a connection channel.

148. A microfluidic reactor according to claim 145, wherein the reaction cells comprise a photoillumination chamber and a reaction chamber which partially overlap with each other.

149. A microfluidic reactor according to claim 145, wherein the reaction cells comprise a photoillumination chamber and a reaction chamber which completely overlap with each other.

150. A microfluidic reactor adapted for in situ use of photogenerated reagents, wherein the reactor comprises an inlet channel , an illumination chamber, a connection channel, a reaction chamber, and an outlet channel, wherein the illumination chamber connects with the inlet channel, the connection channel connects the illumination chamber and the reaction chamber, and the outlet channel connects with the reaction chamber.

151. Use of the reactor according to claim 1 in making chemical compounds.

152. Use of the reactor according to claim 50 in making chemical compounds.

153. Use of the reactor according to claim 1 in screening chemical compounds.

154. Use of the reactor according to claim 50 in screening chemical compounds.

155. Use of the reactor according to claim 1 in assaying chemical compounds.

156. Use of the reactor according to claim 50 in assaying chemical compounds.

157. A method of making the reactor according to claim 1 comprising the step of photolithographically producing a microfluidic template which is adapted for bonding to one or more windows.

158. A method of making the reactor according to claim 50 comprising the step of photolithographically producing a microfluidic template which is adapted for bonding to one or more windows.

159. A method for enhancing parallel photochemical reactivity in a microfluidic reactor having a plurality of isolated reaction cells, said method comprising the step of providing spatially separated or overlapping illumination and reaction chambers in each reaction cell.